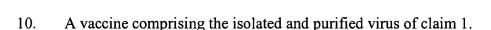




WHAT IS CLAIMED IS:



- 1. An isolated and purified recombinant influenza virus comprising a mutant ion channel protein which lacks or has reduced activity relative to the corresponding wild-type ion channel protein.
- 2. The isolated and purified virus of claim 1 wherein the mutant ion channel protein is a chimeric protein
- 3. The isolated and purified virus of claim 1 wherein the mutant ion channel protein comprises at least one amino acid substitution.
- 4. The isolated and purified virus of claim 3 wherein the substitution is in the transmembrane region of the ion channel protein.
- 5. The isolated and purified virus of claim 1 wherein the mutant ion channel protein comprises a deletion.
- 6. The isolated and purified virus of claim 1 wherein the ion channel protein is the M2 protein of influenza A virus.
- 7. The isolated and purified virus of claim 1 wherein the ion channel protein is the NB protein of influenza B virus.
- 8. The isolated and purified virus of claim 1 wherein the ion channel protein is the CM1 protein of influenza C virus.
- 9. The isolated and purified virus of claim 1 wherein the recombinant virus further comprises a heterologous immunogenic protein of a pathogen.



- 11. A method of preparing a recombinant influenza virus comprising a mutant ion channel protein which lacks or has reduced activity relative to the corresponding wild-type ion channel protein, comprising:
- (i) contacting a host cell with a plurality of influenza vectors so as to yield recombinant influenza virus, wherein the plurality of vectors comprises: a) at least two vectors selected from a vector comprising a promoter operably linked to an influenza virus PA cDNA linked to a transcription termination sequence, a vector comprising a promoter operably linked to an influenza virus PB1 cDNA linked to a transcription termination sequence, a vector comprising a promoter operably linked to an influenza virus PB2 cDNA linked to a transcription termination sequence, a vector comprising a promoter operably linked to an influenza virus HA cDNA linked to a transcription termination sequence, a vector comprising promoter operably linked to an influenza virus NP cDNA linked to a transcription termination sequence, a vector comprising a promoter operably linked to an influenza virus NA cDNA linked to a transcription termination sequence, a vector comprising a promoter operably linked to an influenza virus M cDNA linked to a transcription termination sequence, and a vector comprising a promoter operably linked to an influenza virus NS cDNA linked to a transcription termination sequence, wherein the M cDNA comprises mutant ion channel protein DNA; and b) at least two vectors selected from a vector comprising a promoter operably linked to a DNA segment encoding influenza virus PA, a vector comprising a promoter operably linked to a DNA segment encoding influenza virus PB1, a vector comprising a promoter operably linked to a DNA segment encoding influenza virus PB2, a vector comprising a promoter operably linked to a DNA segment encoding influenza virus NP, a vector comprising a promoter operably linked to a DNA segment encoding influenza virus HA, a vector comprising a promoter operably linked to a DNA segment encoding influenza virus NA, a vector comprising a promoter operably linked to a DNA segment encoding influenza virus M1, a vector comprising a

promoter operably linked to a DNA segment encoding an ion channel protein, and a vector comprising a promoter operably linked to a DNA segment encoding influenza virus NS2; and

- (ii) isolating the virus.
- 12. The method of claim 11 wherein the mutant ion channel protein is a mutant influenza virus ion channel protein.
- 13. The method of claim 11 wherein the mutant ion channel protein is an influenza virus A ion channel protein.
- 14. A vector encoding a chimeric protein comprising the ectodomain of an influenza virus ion channel protein linked to a transmembrane domain of a heterologous protein linked to a cytoplasmic domain that is not the cytoplasmic domain of hepatitis B core.
- 15. The vector of claim 14 wherein the heterologous transmembrane domain is from a protein that is not an ion channel protein.
- 16. The vector of claim 14 wherein the cytoplasmic domain is that of an influenza virus ion channel protein.
- 17. The vector of claim 16 wherein the heterologous transmembrane domain is from an influenza virus protein.
- 18. A method to immunize a vertebrate, comprising: contacting the vertebrate with an effective amount of the recombinant virus of claim 1.
- 19. The method of claim 18 wherein the vertebrate is an avian.

- 20. The method of claim 18 wherein the vertebrate is a mammal.
- 21. The method of claim 18 wherein the vertebrate is a human.
- 22. A composition comprising a plurality of influenza vectors, comprising:
- a) at least two vectors selected from a vector comprising a promoter operably linked to an influenza virus PA cDNA linked to a transcription termination sequence, a vector comprising a promoter operably linked to an influenza virus PB1 cDNA linked to a transcription termination sequence, a vector comprising a promoter operably linked to an influenza virus PB2 cDNA linked to a transcription termination sequence, a vector comprising a promoter operably linked to an influenza virus HA cDNA linked to a transcription termination sequence, a vector comprising promoter operably linked to an influenza virus NP cDNA linked to a transcription termination sequence, a vector comprising a promoter operably linked to an influenza virus NA cDNA linked to a transcription termination sequence, a vector comprising a promoter operably linked to an influenza virus M cDNA linked to a transcription termination sequence, and a vector comprising a promoter operably linked to an influenza virus M cDNA linked to a transcription termination sequence, wherein the M cDNA comprises a mutant ion channel protein DNA; and
- b) at least two vectors selected from a vector comprising a promoter operably linked to a DNA segment encoding influenza virus PA, a vector comprising a promoter operably linked to a DNA segment encoding influenza virus PB1, a vector comprising a promoter operably linked to a DNA segment encoding influenza virus PB2, a vector comprising a promoter operably linked to a DNA segment encoding influenza virus NP, a vector comprising a promoter operably linked to a DNA segment encoding influenza virus HA, a vector comprising a promoter operably linked to a DNA segment encoding influenza virus NA, a vector comprising a promoter operably linked to a DNA segment encoding influenza virus NA, a vector comprising a promoter operably linked to a DNA segment encoding influenza virus M1, a vector comprising a promoter operably linked to a DNA segment

encoding an ion channel protein, and a vector comprising a promoter operably linked to a DNA segment encoding influenza virus NS2.

- 23. The composition of claim 22 further comprising a vector comprising a promoter operably linked to a DNA fragment of interest in antisense orientation.
- 24. The composition of claim 23 wherein the vector comprises a DNA fragment which encodes an immunogenic polypeptide or peptide of a pathogen.
- 25. Isolated virus prepared by the method of claim 11.
- 26. A host cell contacted with the virus of claim 1 or 25.